



# National Weather Service Radiosonde Observations

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## Twice a Day, Everyday

For more than 50 years, twice every day, from nearly 100 locations in the United States, the National Weather Service launches weather balloons, carrying instrument packages called radiosondes. Radiosondes contain sensors which measure upper-air conditions such as atmospheric pressure, temperature and humidity. The radiosonde also tracks wind speed and direction. Meteorologists use this information to prepare weather forecasts. This information is also important for aviation safety.

A battery powered device (the newest version is about the size of a milk-carton) relays this information to a sensitive ground receiver at a tracking station near the launch site. Information recorded from the radiosondes is fed into a super computer, in conjunction with radar, satellite and automated observations, to provide initial conditions for weather forecasts. NWS meteorologists also analyze individual radiosonde data to prepare short-term local weather forecasts. This information helps forecasters predict local weather phenomena such as atmospheric instability, freezing levels, wind shear, floods, ice storms, severe thunderstorms, tornadoes, microbursts, flash floods and maximum temperature.

The radiosonde flight can last in excess of two hours, and during this time the radiosonde can be lifted over 100,000 feet and drift more than 125 miles from the release point. When the balloon has expanded beyond its elastic limit and bursts, a small parachute slows the descent of the radiosonde, minimizing the danger to lives and property. Only about 25 percent of radiosondes released by the NWS are found and returned to the NWS for reconditioning. These rebuilt radiosondes are used again, saving the NWS the cost of a new radiosonde.

Worldwide, there are more than 900 upper-air observation stations using 15 major types of radiosondes. Most stations are located in the Northern Hemisphere and all observations are taken at the same times each day at 00:00 and 12:00 UTC, 365 days per year. Observations are made by the NWS at 93 stations—69 in the continental United States, 13 in Alaska, 10 in the Pacific, and 1 in Puerto Rico.

Through international agreements, radiosonde data are exchanged between countries and are applied to a broad spectrum of efforts. Applications include: data initialization for global and regional numerical prediction models; input for air pollution/dispersion models; severe storm, general, aviation, and marine forecasts; ground truth for satellite data; weather

research; and climate change studies.

## **NWS Operational Use of Radiosonde Observations**

Accurately predicting changes in the atmosphere ranging from severe thunderstorms to global climate change requires adequate observations of the upper atmosphere. The NWS radiosonde network is the National Weather Service's primary source of upper-air data.

## **Radiosonde Data are Critical to NWS Numerical Weather Prediction**

Radiosonde data are fed into numerical weather prediction (NWP) models and, are assimilated with other observations to provide initial model predictions. Radiosonde sites in the continental United States are about 235 miles apart. Because the NWP model grid resolution is much smaller than the spacing of radiosonde sites, the loss of data from only one or two radiosonde sites can significantly impact model forecasts. Studies have shown that when missing radiosonde observations occur, small scale weather features above the surface can be lost or inaccurately positioned in the data analysis, causing significant errors in the model predictions. This especially holds true during severe weather episodes.

## **Radiosonde Data are Critical to Local Weather Prediction**

NWS meteorologists also analyze individual radiosonde soundings to help prepare short-term, local weather forecasts. Individual soundings help forecasters determine many local weather parameters including, atmospheric instability, freezing levels, wind shear, water, and icing potential. Data from radiosondes helps meteorologists forecasts conditions such as the following: severe thunderstorms, tornadoes, micro bursts, flash floods, ice storms, aircraft icing conditions and turbulence, cloud heights and maximum temperature. Just one missing radiosonde sounding can degrade the forecast accuracy of severe weather events and thus it is essential that all radiosonde sites report observations on a routine basis.

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